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THESIS

SNAP II: SHIPBOARD MICROCOMPUTER APPLICATIONS IN PERSONNEL, ADMINISTRATION, AND TRAINING - A USER'S PERSPECTIVE

by

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SNAP II: Shipboard Microcomputer Applications In Personnel, Administration, and Training - A User's Perspective

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ABSTRACT

This thesis describes the functional requirements of the Shipboard Non-Tactical Automated Data Processing Program (SNAP II): a microcomputer system designed to automate formerly manual procedures in the areas of shipboard supply, maintenance, and personnel/administration. A proposed Personnel Readiness and Training Management Subsystem (PTMS) is also described. Both systems are analyzed from a user's perspective. Recommendations are made regarding installation approach and composition of implementation teams. Applications for potential inclusion in SNAP II are also recommended.

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I. INTRODUCTION AND HISTORICAL DEVELOPMENT OF SNAP

A. INTRODUCTION

The mid-grade officer shortage in the U.S. Navy is well known and documented. Results of FY 80/81 Officer Separation Questionnaires indicate why attrition is high among this group of officers. The top three reasons cited for separation were, (1) insufficient pay, (2) too much family separation, and (3) too much crisis management. [Ref. 1]

Crisis management was defined by resignees as excessive, unnecessary paperwork, inspections, and long hours. To alleviate this problem, steps have been taken to cancel, consolidate or extend periodicity of various inspections and externally required administrative reports. Operational excellence has been linked to inspection validation so that units that demonstrate superior performance are rewarded with reduced administrative requirements.

One of the most significant developments in recent years has been the development of the Shipboard Non-Tactical Automated Data Processing Program or SNAP. This ambitious program will culminate in the installation of interactive, menu driven microcomputers aboard fleet units for the purpose of automating certain manual administrative functions. SNAP is in direct support of Chief of Naval

Operations Objective 5, "to reduce the administrative burden on the fleets". The automation of administrative functions aboard ships should result in increased efficiency of personnel utilization through time savings and increased accuracy of report generation. SNAP should be an important step toward solving the administrative burden of crisis management. Beneficial downstream effects of increased personnel effectiveness, job satisfaction, retention, and readiness can be realized as well.

This thesis will describe the historical development of the SNAP concept in chapter I. Chapter II will detail the integrated functional description of SNAP II, the microcomputer system to be installed on small ships. Chapter III will describe the functional capabilities of the Personnel/Administrative/Training subsystem proposed for SNAP II (PTMS) and chapter IV contains a critical analysis of both SNAP and PTMS. Chapter V will propose suggestions for future applications in the functional areas of Personnel/Administration/Training and recommendations for implementation of SNAP II.

B. SNAP I - UYK-5 COMPUTER REPLACEMENT

The AN/UYK-5(V) computer system was introduced to the fleet in the mid-1960's to support the 3-M (Maintenance and Material Management), SUADPS (Shipboard Uniform Automatic Data Processing System), and accounting/financial functional

areas. The UYK-5 is now installed in 54 large ships; aircraft carriers, combat stores ships, amphibious assault ships, tenders, repair ships, as well as 17 marine air groups. Additionaly, 12 shore sites exist to support operational units.

The UYK-5 computer system suffers from a number of problems which have mitigated its effectiveness. [Ref.2: p.2] One of the most significant problem areas is the age of the system. This second generation serial processing computer system is now over 15 years old and is suffering from decreased mean time between failures. Spare parts are scarce as the system is out of production. Another problem associated with the UYK-5 is saturation. Many larger sites operate on a three-shift-a-day, seven-day-week basis with user processing requirements still not met. A number of new programs have been proposed for implementation which would further overburden the system. These include PASS (Pay and Personnel Administrative Support System), CORS (Composite Operational Reporting System), VAMOSC (Visability and Management of Support Costs), NALCOMIS (Naval Aviation Logistics Command Management Information System), and DEAS (Data Entry Aboard Ship).

In 1974 OP-91, now the Naval Data Automation Command (NAVDAC), initiated a study in response to the age and saturation problems of the UYK-5 computer. [Ref.3: p.2]

Core expansion, replacement of tape drives, printers and other peripherals was investigated. A new CPU and source data automation equipment was recommended. In 1976 OP-91 requested funds to replace the UYK-5 in two phases; phase 1 would replace the tape drives and printers, phase 2 would replace the CPU and other peripherals. Naval Sea Systems Command (NAVSEA) developed the Plan and Milestones and the Chief of Naval Operations (CNO) approved the two-phase replacement that same year. SNAP I was born.

C. SNAP II-ADP SUPPORT FOR SMALLER SHIPS

Concurrently, the possibility of providing the same type of ADP support to smaller ships was being discussed in the Navy community. In 1970 the Vice Chief of Naval Operations had suggested to the CNO that small computers could be used aboard DLG-size ships to improve general personnel support and management. [Ref. 4]

A number of feasibility studies were conducted in the shipboard environment as a result of the CNO's desire to pursue ADP applications in the fleet. Computer systems aboard USS FOX, USS DAHLGREN, and USS GRIDLEY delt primarily with 3-M applications. USS BRADLEY installed DEAS and USS MULLINNIX and USS ALBANY studied CORS, 3-M, and supply functional aspects.

The DAHLGREN tests showed that even with selective manning, ship's force personnel were unable to successfully

deal with emergent system operation and supporting software problems. The crew was unable to fully develop programs due to time constraints but once these applications were designed, the shipboard organization became very dependent upon them. System reliability played a direct role in crew enthusiasm. Automated requisition status and personnel files were cited as extremely useful management devices. It became apparent from the DAHLGREN studies that the final shipboard ADP must be reliable, easy to maintain, and have a software package that is centrally programmed, debugged and revised.

The DEAS program was initiated by the Naval Supply Systems Command to provide for more rapid transferral of supply data between ships and shore supply activities. DEAS tests aboard MULLINNIX and ALBANY showed that DEAS demonstrated a significant potential for improving supply management aboard ships. [Ref.2: p.5] For example, OPTAR (Operational Target) budget maintenance time was reduced from two hours per day (manual) to 15 minutes per day (automated). The CORS study indicated great potential for reducing errors and speeding preparation of formatted messages.

Non-standard microcomputers have appeared throughout the fleet as commanding officers buy off-the-shelf systems in an attempt to cope with administrative burdens. Higher echelons in the Navy cite higher aquisition, software

development, and maintenance costs as reasons for the development of a standardized, central ADP program for the fleet.

In response to the requirement for a centralized ADP program, NAVSEA has been designated to procure a modular expandable system that will meet the ADP requirements of large and small ships as well as the supporting shore establishment. SNAP I will support large ships and shore commands while SNAP II will support the smaller ships. It is anticipated that a Navy-wide ADP system will result in benefits in the areas of standardization of hardware and software and economies of scale in procurement, software development, and hardware maintenance.

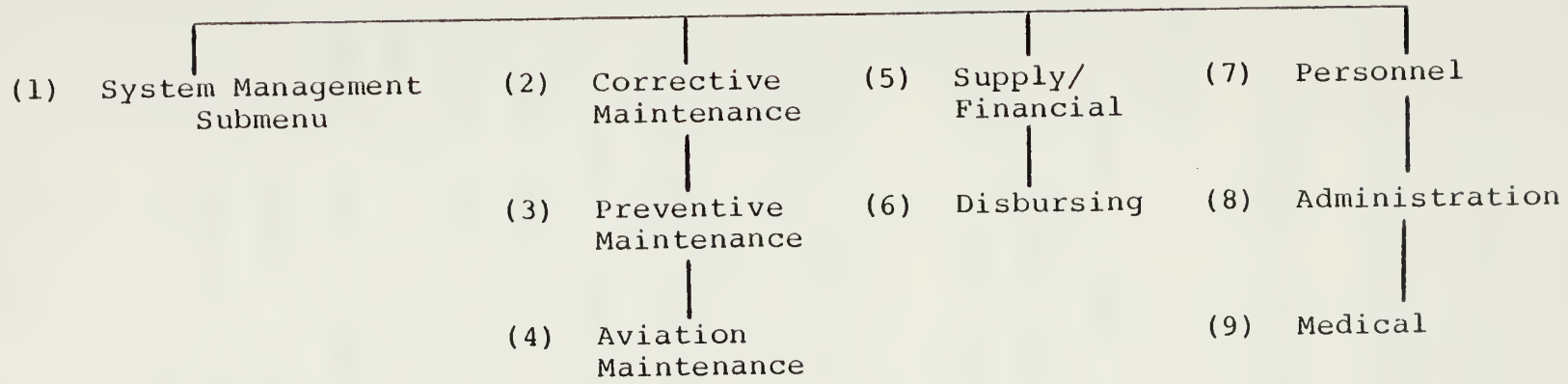
II. SNAP II INTEGRATED FUNCTIONAL DESCRIPTION

A. INTRODUCTION

The purpose of SNAP II is to replace manual functions with automated systems to support the organizational, non-tactical requirements of small ships. The system includes the functional areas of maintenance, supply, disbursing, personnel, administration, and medical. The Chief of Naval Material (CHNAVMAT) was tasked to provide ADP development plans for SNAP II. NAVSEA, under the direction of CHNAVMAT, was directed to develop hardware and software specifications to satisfy shipboard management information and non-tactical requirements.

On 30 March, 1981 CHNAVMAT published the final Integrated Functional Description (IFD) for SNAP II. This document contains the final description of the functions to be included in the initial, nucleus SNAP II software release in mid-1982. The IFD also contains specifications for future applications to be included in follow-on software updates. [Ref.5]

SNAP II hardware will be broken into nine distinct subsystems or submenus as indicated in Figure 1. SNAP II will be designed to automate current manual systems with the flexibility and expandibility to accept new applications.



SNAP II MENU

FIGURE 1

The anticipated advantages of the system are as follows:

(1) reduction of administrative requirements by eliminating certain manual, online files;

(2) elimination of certain manual report generation through automatic report preparation and;

(3) reduction in error rates and time to review and correct documents by online data validation.

B. BACKGROUND

SNAP is managed under the auspices of OPNAVINST 5230.16 and is under the policy guidence of the Fleet Non-Tactical ADP Policy Council. The program itself consists of two major efforts:

1. SNAP I - replaces ship and shore based UYK-5 computers with third generation, standard automated information hardware and software.

2. SNAP II - provides smaller ships and selected shore activities with a standard ADP system compatible with SNAP I hardware and software.

The key concept behind the SNAP program is that fleet operational and support activities, both afloat and ashore, will be provided with a standard, automated information system. Functional requirements for all SNAP installations will be identical even though the hardware and software packages may be varied. Different vendors will be required to meet the same functional specifications to ensure that fully compatible and integrated support exists for all SNAP systems.

All SNAP systems will be equipped with telecommunications capability. The nucleus electronic transfer of information capability will consist of offship diagnostic software trouble-shooting between SNAP I and SNAP II computers. Communication between SNAP and non-SNAP computers will be accomplished via offline, machine-readable media (tapes, cartidges, disks, paper tapes, cards).

C. OBJECTIVES

The primary goal of SNAP II is to achieve CNO objective number 5, "to reduce the administrative burden on the fleet". To support this objective SNAP II will automate functions in the areas of maintenance, supply, pay, personnel, administration, and medical/dental. The system should be designed to run without operators in an unmanned space. SNAP II should also be designed to be utilized by functional area specialists currently assigned with no increased manning requirements associated with indoctrination and use through the employment of menu techniques and online help functions. Offship formal training requirements should be reduced as a result. The use of standard operations across fleet installations should assuage learning time needed for inter-unit transferees.

D. SPECIFIC PERFORMANCE REQUIREMENTS

System inputs will be in two forms: (1) online user input and (2) offship input via magnetic media. Input data validation will be conducted internally prior to utilization. Error messages should inform the user of incorrect input for his correction in the case of user entry. Offship data input will be corrected by the user, if possible, or returned to the originator for correction.

A goal of system response time of three seconds or less has been established for single file access and/or data element validation actions. Response time is defined as the time between executing the action code, e.g. pressing the ENTER key, and the time of the display of the first character of the response on the terminal. Actions requiring longer processing times, such as multiple file access or the setting up of new files, will display a message indicating that the requested action is in progress. The goal here is to inform the user that the system understands his query and is acting accordingly. This objective is key to user acceptance and reduced operator frustration.

E. FUNCTIONAL AREAS

1. Maintenance

The maintenance subsystem should provide automated information to aid supervisors to effectively manage ship's

maintenance requirements. SNAP II will support the Current Ship's Maintenance Plan (CSMP) to aid the commanding officer in the management and prioritization of efforts to correct material deficiences. The Ship's Force Work List (SPWL) will be incorporated to permit enhanced flexibility in managing the expenditure of ship's force manhours.

The system should ensure correct source data transmission to outside activities thereby increasing the accuracy and effectiveness of maintenance information for the generating and receiving units. Administrative workload should be assuaged by the replacement of manual logs and files with automated entries. The maintenance subsystem should provide simple menu selection of routines for repetitive work thus increasing maintenance action speed and quality. Low level maintenance men will be able to automatically order parts and track their progress through the supply system thereby increasing the effectiveness of the maintenance/supply interface.

The SNAP II maintenance subsystem should also provide skeleton formats for reports now prepared manually such as Casualty Reports (CASREPTS) and Unit Reports (UNITREPS). The system should also assist in work package maintenance, management, and automated transfer via magnetic or hardcopy means. An automated Trouble Log should permit better management of emergent ship's force work. Special

scheduling/management programs should be provided to assist supervisors to better manage work accomplishment during the complex overhaul evolution.

The maintenance subsystem should support the Preventive Maintenance System (PMS) and will automatically process the Quarterly Force Revision (QFR). Schedule preparation and assistance for PMS and the QFR will be provided as well. Weekly schedules of required maintenance actions for the upcoming week will be obtainable from the SNAP II system. This scheduling aid should compensate for the ship's schedule, equipment status, and absence of key technical personnel and alert managers to potential scheduling problems. Detailed assistance for maintenance men should be provided through automated Tag Out Log and Equipment Guide List (EGL) information where needed. PMS schedules can be monitored throughout the maintenance cycle to provide managers with work breakdown analysis of work loading, thereby keeping supervisors constantly aware of potential manning constraints. The ship's schedule, corrective maintenance outstanding, and preventive maintenance due will be used in this analysis.

Specific maintenance functions for the initial and future software releases of SNAP II and detailed functional descriptions may be found in reference 5, enclosure 2, pages 15-21.

2. Supply

The supply subsystem should automate current manual supply procedures in the areas of inventory control, financial accounting, Special Accounting Class 224, food service, and ship's store. Labor intensive file maintenance and record keeping are currently the practice in these functional areas. SNAP II automation is intended to eliminate routine filing, eliminate simple arithmetic and clerical errors, and automatically generate forms needed for daily supply operations. The system will automatically process incoming magnetic and machine-readable supply information, thus mitigating manhour consuming and error prone data entry and filing.

The inventory control function should be accomplished by online generation, editing, and procurement of user requirements. The system will track the supply requirement from the generation of the request through the onboard receipt of the material. Online information regarding supply parts status will be provided for the monitoring of requirements. The supply subsystem will allow for the recording of issues, recording of demand, periodic reorder of material, setting of reorder levels, and adjustment of inventory by receipt or inventory. Online record maintenance should improve accuracy and assuage the need for labor intensive, error prone maintenance of paper files.

The financial accounting function should include the functional areas of internal budgeting, OPTAR record keeping, and consumption. The internal budgeting system should be flexible enough to allow the tailoring of budget reporting to any desired level; different departments may require different types of budgeting with various funding categories. OPTAR accounting will provide for the Current OPTAR report, ten day transmittals, Summary Filled Order Expenditure Difference Listing (SFOEDL), and Age Unfilled Order Listing (AUOL). These reports will be generated and received by magnetic tape and processed online thereby reducing manual research.

SNAP II should also allow for the use of standard inventory control tools to support control of Special Accounting Class 224 material carried on replenishment ships. Procurement, receipt, and issue functions will be supported on oilers and ammunition ships as a result.

The clerical functions of the Mess Management Specialist rating should be automated by the food service function. Assistance in menu planning and preparation as well as inventory control and return generation should be provided. The inventory control function should assist the food servicemen in a number of areas. Inventory management assistance should be provided in the areas of manual and automatic procurement of food supplies. For example, when

a preset low end reorder limit is reached, inventory will be ordered for restock. Information on future menu needs will be used to order predeployment loadouts or to top off inventories prior to underway replenishment (UNREP). Other areas of inventory support include breakout and receipt assistance, the prevention of food spoilage via stock rotation, and the support of food transfer to both general and private dining facilities.

The return generation subfunction of the food service function provides aids for inventory, stock reconciliation, and automatic provision of returns. The menu planning and preparation subfunction will prepare and print menus. It should also generate breakout forms taking into account the menu selected and the number of servings to be prepared. Food preparation worksheets will also be provided to assist in menu preparation.

The ship's store function should improve the accuracy of records and reduce the administrative burden on ship's store personnel through the utilization of point-of-sale inventory control and automatic record updates. Automated procurement assistance will be provided via on-line menu selection of procurement documents. For example, the input of stock quantities required can be used to review, on the terminal, stock requiring reorder and procurement. This mode can be used, while a salesman or vendor is

present, to review status of previously ordered inventory or to prepare procurement documents for stocks requiring.

The ship's store function should also assist in inventory management, the prevention of accumulated stock items through stock rotation, and the definition of inventory levels and automatic reorder relevent to the ship's future operating schedule. The system can also support a markup system based on the policies set down by the ship's Commanding Officer. This markup scheme can be keyed to volume or category of sales.

A detailed description of specific supply functions can be found in reference 5, enclosure 2, pages 21-38.

3. Disbursing

SNAP II should provide support to three areas of the personnel pay system; (1) military pay, (2) travel pay, and (3) cash book maintenance. The online pay system should aid in the preparation of the following services; automatic pay calculation, Leave and Earnings Statements (LES), payment documents, checks, and supporting paperwork such as allotments. The system should also mesh with the cash book to ensure proper posting. The SNAP II pay system should generate travel claims given input of the traveller's schedule and input of other expenses selected from a menu checklist. The system will also make sure that personnel filing claims for similar trips will receive comparable

reimbursement. Cash book accounting will be automated as well. Accurate posting of cash book entries should be accomplished through an interface between the pay and travel functions. The disbursing function requires unique security precautions and SNAP II should provide the necessary security measures to prevent unauthorized access and use.

A list of disbursing functions may be found in reference 5, enclosure 2, pages 37-38.

4. Personnel

Portions of the service record suitable for automation should be maintained by SNAP II. Privacy Act safeguards will be included to ensure proper disclosure of personnel information. The system should ease the transfer of personnel through the use of magnetic tape cartridges. Magnetic media will provide for the automated input of personnel data to the receiving command. Page 13 entries and portions of page 4, 5, 6, and 7 entries do not lend themselves to automation and will remain in hardcopy form. System integrity should be maintained through automatic preparation of paper copies of service record entries prior to transfer. Automated service record entries will support a personnel data base for administrative and departmental reports. This data base will be the only site of personnel-related information. Due to Privacy Act constraints, only personnel with proper authority will be allowed to change or delete personnel data in this file.

A more detailed description may be found in reference 5, enclosure 2, pages 38-43.

5. Administration

Three classes of users will be accomodated by the administrative subsystem; (1) the Executive Department, (2) other departments, and (3) embarked units. The Executive Department's functions should encompass the entire crew, while the individual departmental functions will be tailored to the information needs of each department head. Functional areas common to both management levels include a general inventory management aid, a training administration support program, and word processing. Embarked unit support will be given in the areas of clerical, training support, and word processing.

Executive Department functional aid can be segregated into five categories:

(1) basic clerical support,

(2) personnel clerical support,

(3) inventory management,

(4) training administration,

(5) word processing.

Basic clerical support will entail a tickler system to aid in the timely submission of externally required reports and response to correspondence. Library control of administrative publications and logs and records maintenance should

also be accomplished through basic clerical support. Personnel clerical aid should be affected through an interface with the personnel data base. Authorized users should be able to review data for use as inputs to a wide range of personnel bills needed to support the ship's operational requirements.

The initial training support system will support the recording of ship's training requirements and onboard personnel qualifications. Word processing should help integrate the Executive Department functions. SNAP II should facilitate the transfer of information between data processing files and the word processing system.

Aid to other departments should consist of four support areas:

(1) basic clerical,

(2) inventory,

(3) training administration,

(4) word processing.

Basic clerical support should consist of an online log and record keeping capability similar to the support provided to the Executive Department, but on a more limited basis. The inventory system will provide assistance in maintaining records of tools, general purpose electronic equipment (GPETE), and the like. The training subsystem should enable department heads to more effectively utilize scarce

training resources through the planning and recording of individual and ship training opportunities. The word processing capability available to the departments will be similar to that afforded to the Executive Department to assist in general administration.

Embarked units should be provided services similar to those received by ship's departments. Embarked staffs and aviation detachments will be considered as just another department in the SNAP II scheme.

A list of administrative requirements is found in reference 5, enclosure 2, pages 38-43.

6. Medical

The medical subsystem should provide support in three basic functional areas:

(1) personnel system interface,

(2) inventory control,

(3) diagnostic support.

The personnel system interface will support special programs such as shot records and the audiogram program. It will also aid in the scheduling of medical and dental appointments. The inventory control system should permit accurate record keeping of required medical materials and instruments. The diagnostic aid capability should help the duty corpsman diagnose sickness through the input of patient symptoms and feedback responses.

A more detailed description of the functional requirements may be found in reference 5, enclosure 2, pages 42-43.

F. IMPACTS

The main impacts of SNAP II can be described in terms of two categories: (1) the impact on the ship and, (2) the impact between the ship/shore establishment's operational philosophy.

1. Equipment Impacts

The main impact on hardware exists in the ship/shore interface. The present ship/shore interface is accomplished by manual, non-automated means, e.g., hardcopy reports, messages, microfiche, etc. The ship/shore interface must utilize the automated transfer of data/information if the goal of reduced administrative burden is to be obtained. This will require a ship/shore hardware/software interface to ensure a smooth, two-way exchange of information between data bases. In other words, SNAP I and II must be functionally compatible.

2. Software Impacts

Since no current automated systems are being replaced, software impacts are considered to be negligible. The ship impact should be mainly in the area of training required to operate SNAP efficiently and effectively. The shore establishment impact will be considerable, however,

since dramatic changes in existing shore software will be required to ensure proper integration with automated fleet units. The shore commands will also be required to operate manual and automated systems concurrently for the five or six year installation phase.

3. Organizational Impacts

Onboard ships, the major organizational impact of SNAP II will be the shift from manual to ADP methods and the attendant restructuring of work tasks. This reallocation of effort will result in additional workload in some areas and a workload mitigation in other areas. The overall effect of this workload redistribution should be greater efficiency and thus more work accomplishment. The organizational training impact should result in orienting training requirements toward a broad category of general user rather than setting up a training program for each clerical user in a new organizational structure. This additional training impact should be assuaged, in time, as Navy schools incorporate the SNAP methodology into their training requirements.

The organizational impact on the interface with the shore establishment is an area where functional sponsors will need to take decisive action to ensure the success of SNAP. Shore commands will need to overhaul their "paperwork" philosophy of operations. Hardcopy reports, as inputs to fleet data bases, must be restructured and consolidated to

permit automated transfer to fleet units. The shore establishment must ensure that information exchanges between shore commands and fleet units are via automated means. The receipt and processing of information must be automatic, precluding the need to manually enter data or create paper documents for offship transmittal. Interfaces must be built into the system that require no data processing expertise except the ability to mount the input tape or cartridge when called for. System design must also preclude the need for storage of a vast library of magnetic tapes or disks.

III. PROPOSED PERSONNEL READINESS AND TRAINING MANAGEMENT SUBSYSTEM

The previous chapter described the functional requirements for the SNAP II software to be installed on small ships in the 1980's. This chapter will describe a shipboard personnel readiness and training management system proposed for inclusion in the SNAP II software package.

A. BACKGROUND

Personnel lacking the required skills to operate and maintain ship's systems adversely impact upon material readiness in the shipboard environment. Currently, manual procedures are used almost exclusively to manage personnel and training functions aboard ships. As a result, such functions as receipt, assignment, training, qualification allocation and detachment of ship's company involve excessive manhours and a relatively high probably of errors which result in decreased efficiency and effectiveness of ship's force personnel. [Ref.6: p.1]

The shipboard personnel readiness and training management subsystem is an effort to improve overall ship's material readiness by improving the ship's maintenance management.

The Maintenance System Development Program (MSDP) is the focus of this effort and as directed by the Naval Sea Systems Command (NAVSEA) under the sponsorship of the Deputy Chief of Naval Operations for Logistics. MSDP investigators observed, in 1979, that the "...Navy's maintenance information systems, generally, have been designed to serve the functional needs of analysts and managers external to the ship." [Ref.6: p.2] These externally generated information requirements failed to recognize the information needs of the shipboard manager nor did they realize his inability to produce the required information accurately and on time without an inordinate consumption of available ship's manhours. MSDP investigators observed that information quality, and attendant decisions regarding maintenance system management and material readiness, could be improved through the introduction of an integrated computer system for shipboard maintenance management information. They also realized that personnel are an integral part of the maintenance assets of all ships and that a personnel readiness and training management package was required to access the full potential of personnel resources in the maintenance function.

In 1979, NAVSEA commissioned the Navy Personnel Research and Development Center, San Diego (NPRDC) to design the subsystem specifications for a shipboard Personnel

Readiness and Training Management Subsystem (PTMS). NPRDC reviewed the literature regarding personnel data management systems and shipboard non-tactical automated data processing systems and analyzed the manual procedures related to personnel and training management. As a result, NPRDC selected the procedures ammenable to automation and designed the subsystem specifications for a shipboard computer-assisted personnel readiness and training management package. [Ref.6: App. B] NPRDC recommended that the PTMS specifications be used to develop a nucleus personnel readiness and training management capability for the SNAP II system. [Ref.6: p.6] PTMS was developed by LCDR John A. Dollard at NPRDC. This chapter will summarize the PTMS capabilities recommended for inclusion in the SNAP II software package.

B. PTMS REQUIREMENTS

PTMS was designed to automate manual personnel and training functions aboard ships. The objectives of PTMS are to: (1) mitigate administrative personnel and training workload associated with ship's maintenance management and, (2) improve personnel readiness and training management. PTMS is intended to automate repetitive aspects of the personnel and training functions including personnel receipt, assignment and transfer, training scheduling, qualification monitoring, and personnel forecasting. PTMS

is intended to automate repetitive aspects of the personnel and training functions including personnel receipt, assignment and transfer, training scheduling, qualification monitoring, and personnel forecasting. PTMS should reduce the time and work required to access personnel/training information and provide better control in this area. PTMS should also reduce database errors through interactive source data entry, eliminate repetitive data inputs, and generate automatic personnel/training reports, thereby improving the accuracy, consistency, and timeliness of these reports. PTMS should also inform managers of personnel skills and deficiencies, schedule and review future training requirements, and forecast availability of personnel qualified to perform maintenance tasks.

PTMS can be used directly by functional users such as division officers, training petty officers, personnelmen, duty section petty officers, etc. Access can be gained via online terminal and printers located in various offices and workcenters around the ship. PTMS should generate selected reports for internal and external information requirements. Offship data and reports will be transmitted in machine-readable form to facilitate integration with the shore-based SNAP I systems.

It is intended that PTMS will support the record keeping and reporting requirements with regard to shipboard

personnel readiness and training management functions. These functions include:

(1) assistance in the performance of preventive and corrective maintenance tasks through the identification of personnel qualification requirements;

(2) inventory maintenance of personnel qualifications and skills;

(3) provision of scheduling aids to ensure the future availability of required skills.

PTMS will be segregated into two modules; (1) personnel readiness and, (2) training management. Seven primary functional areas are included in the PTMS specifications:

(1) ship's personnel office administration,

(2) shipboard personnel assignment,

(3) personnel qualification record keeping,

(4) leave administration,

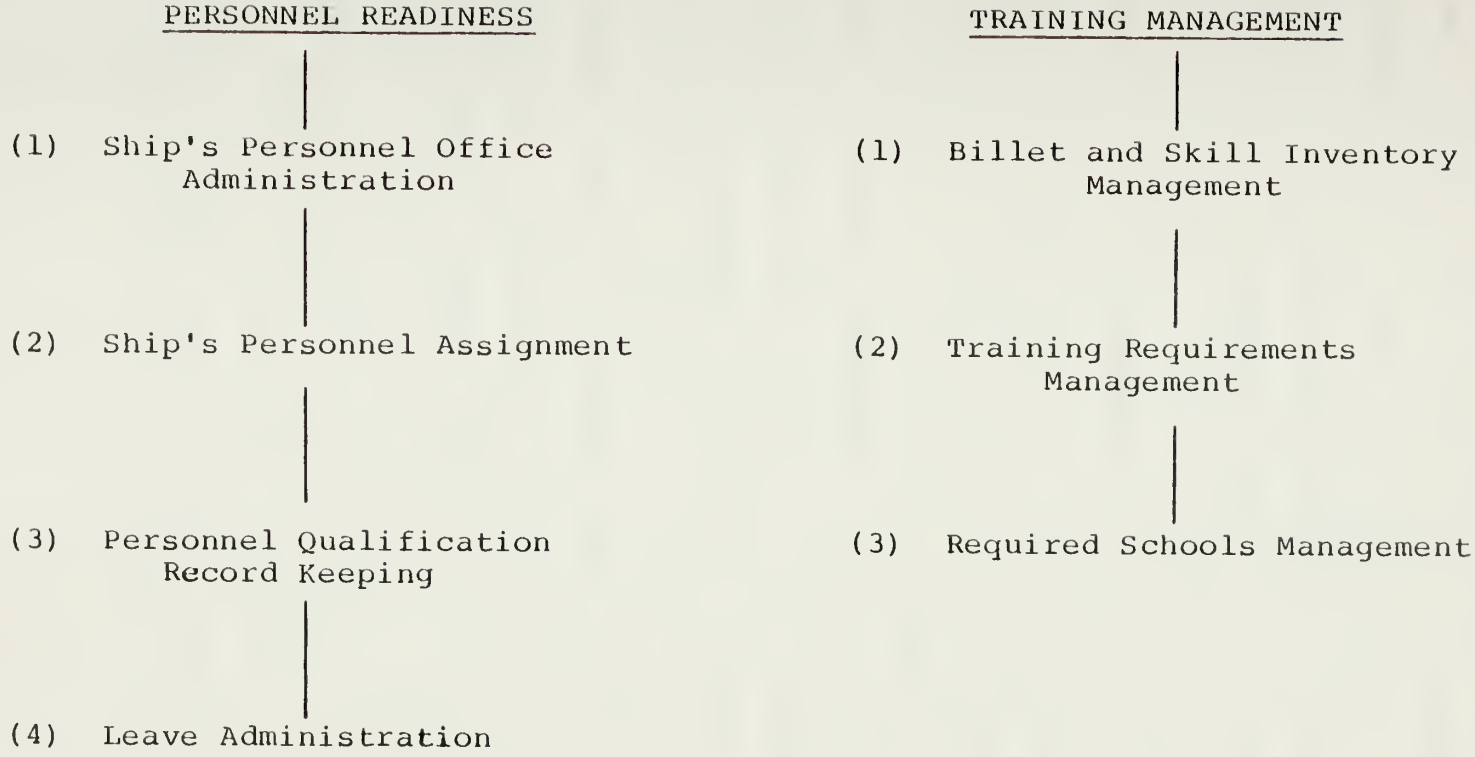
(5) billet and skill inventory management,

(6) training requirements maintenance,

(7) required school management.

These functions are shown in Figure 2. [Ref.6: pp.5-7]

The ship's personnel office administration function includes medical and service record information storage and retrieval, projected personnel gains/losses reporting, optical character reader (OCR) generation of temporary additional duty (TAD) orders and leave papers, and the preparation of check-in and check-out sheets for personnel arriving to and departing from the ship. The shipboard



PTMS FUNCTIONAL AREAS

FIGURE 2

personnel assignment function includes assignment data storage and retrieval, the preparation of personnel assignment rosters and recall bills, and personnel availability forecasts. The personnel qualification record keeping function includes personnel qualification data storage, retrieval and summaries for division officer notebook preparation. Work center PQS progress reporting and requalification requirements reporting is also included. The leave administration function includes data entry and retrieval for leave requests and approval, leave status monitoring, and leave papers preparation. The billet and skill inventory management function includes billet/skill data storage and retrieval, billet assignments, billet/skill requirements monitoring, and Watch Quarter and Station Bill (WQ&SB) generation. The training requirements maintenance function includes training event data storage, retrieval, scheduling, and progress reporting, training requirements summary preparation, and training event history and deficiency reporting. The required school management function includes school data storage, retrieval, course catalog review, required school graduate reporting, course quota control, student assignment and scheduling, and orders preparation for schools.

C. PTMS GENERAL CHARACTERISTICS

PTMS is intended to be an online data base system which includes a file management capability. In other words, a central data base will house various categories of related information for access via remote terminals. Since this one data base will be used for decision making by many managers, accuracy and validity of data will be important considerations for PTMS operation and maintenance. To this end it is essential that PTMS have the capability of cross-checking displayed data during review as well as reviewing information prior to making permanent changes to the data base/files.

Timing constraints require that data processing be accomplished within the framework of a single working day. Significant time savings and reduced personnel workload are a goal of PTMS as well. Another objective of PTMS is to gain user confidence in system reliability by establishing a response time of three seconds or less. That is, within three seconds of final user input the system will display the response or, in the case of more complex data base/file manipulation, the terminal will display a message to tell the user that his request is in progress.

It is also intended that the PTMS software be flexible enough to permit program changes and the addition of new progress. Managers should have the capability to make changes to programs via terminal input. This capability should allow PTMS to evolve as user requirements change over time. The file management capability should give the user the ability to set up his own files for applications unique to his own needs. This ability for each ship to set up its own unique files, separate from the standard PTMS files, is an important part of the overall flexibility afforded by the proposed PTMS package.

PTMS is not intended to be used for the storage of classified material. Therefore the problems associated with the proper disclosure of classified material have been avoided. However sensitive personnel data files protected by the Privacy Act require that positive controls be included in the PTMS design to preclude unauthorized disclosure of private information. The design of PTMS will include two levels of protection to prevent the unauthorized disclosure of sensitive information. Each user will be assigned a unique identification number to be typed on the terminal followed by the entry of a password. Neither of these entry codes will be printed on the terminal when entered to guard against unauthorized disclosure.

After entering the correct identification number and passwork, a main listing, or menu, of PTMS programs will be available to the user. This listing is intend to be keyed to the user identification number and only those programs authorized for access by that particular user will be available. In this way access to sensitive information can be tailored to individuals on a need to know basis.

It is anticipated that each user will be assigned read and/or write privilages as well. Operators assigned "read only" access will be able to review information but will not be allowed to change or enter data. This restricted access should help prevent unauthorized or inadvertent errors in the data base/files.

After the user has properly logged in, he may select the desired program from the menu. The selected program is then loaded into memory and execution begins. At various times during the program execution the computer will query the user for entry of data for processing. After user entry of the required data, the system should verify that the data meets various formatting and edit checks. If the data does not meet these validity checks the terminal should display a message indicating what the problem entails. If a simple typing error has been made, the user can retype the data and continue. However, the user can also request a help message if he desires further information

regarding the data entry error. This message should provide information related to the proper format and context of the data in question. The user can also abort or restart a program as desired. A transaction log file records user inputs to allow file reconstruction in case of a power outage or other system failure. If a function requires access to numerous programs, PTMS will load the required programs for automatic execution. When the user is finished with the program, he can either repeat the same function or return to the menu for selection of another programs.

D. PTMS DATA BASE FILES

The data base is the site of all information for PTMS. This data base is organized into separate files of related information for ease of access. A description of each of these files follows.

1. Personnel Record File (PRF)

The personnel record file is designed to organize information concerning individual crewmembers such as general service data, dependent and next-of-kin data, career/education/training data, and qualification data. The PRF is also designed to organize shipboard assignment data, leave administration data, and medical record data. Each personnel record can be accessed in a number of ways; social security number, last or first name, Navy Enlisted

Classification Code (NEC), division, work center, prospective rotation date (PRD), or a combination of any of these keys. This permits easy, rapid, and flexible entry to service record information.

2. Billet/Skill Inventory File (BSF)

The billet/skill inventory file is designed to contain information concerning each billet's identification data, watchstation and skill/qualification requirements, and personnel assignment data. The file can be entered via billet sequence number or by social security number if the billet is occupied.

3. Training Requirements File(TRF)

The TRF contains data related to the requirement for and status of each training event as well as scheduling data and a training event description. This file is intended to be entered by a preassigned training event identification number.

4. School Requirements File (SRF)

This file is anticipated to contain a listing for each required school. It should list onboard graduates, available course quotas, and class convening dates. This file will be designed to schedule and monitor the progress of up to fifteen students. User access will be via course identification number.

5. Visitor Log Files (VLF)

The VLF should contain information concerning clearance and visits for potential and scheduled visitors to the ship. This file may be accessed by entering the visitor's social security number or his name. Information provided in this file includes visitor's organization, title and clearance, anticipated visit dates, and remarks.

6. Master Locator File (MLF)

The MLF is designed to locate ship's personnel information given a limited amount of known information about the crew-member. This file can be entered via the social security number, first or last name, NEC, division, work center, or PRD. In essence, the MLF provides access to the Personnel Record File to provide information such as home address and phone number and is likely to be used for emergency recalls.

7. Long Title File (LTF)

The LTF is the dictionary of PTMS terms. It is designed to contain codes and short and long titles of the modules, records, files, reports, and functions of PTMS.

8. Transaction File (TXF)

The transaction file is intended to maintain an interim record of all entries and changes to the PTMS data files. It can be entered by keying in time, the sequence number of the transaction or the Julian date. It is anticipated that this file will be periodically transferred to a magnetic tape history file for future reference.

E. PTMS PROGRAM DESCRIPTIONS

The PTMS data base/files previously discussed are used for grouping information only. Information in each file is maintained on a disk for retrieval and transfer to memory as required by the various programs. These programs are the vehicle whereby the user can manipulate needed personnel and training information.

As previously shown in Figure 2, PTMS is divided into two modules; personnel and training management. These two modules contain various functions or groupings of like programs. These programs are grouped together because of common data requirements, operational efficiency, and convenience. The personnel module contains four program groupings:

(1) personnel receipt and transfer,

(2) personnel assignment,

(3) personnel leave.

The training management module has three program groupings:

(1) billet and skill inventory,

(2) training requirements,

(3) required schools.

A description of these groupings and their programs follows.

1. Personnel Receipt and Transfer

The purpose of the personnel receipt and transfer grouping (function) is to permit users to create, delete, review, and update personnel information. This function

is intended to assist users in crewmember check-in and check-out, career counceling, advancement preparation, performance evaluation, leave/school orders preparation, and preventive medicine. There are eight programs contained in the personnel receipt and transfer grouping;

(1) personnel record creation,

(2) personnel record update,

(3) personnel record deletion,

(4) personnel record review,

(5) personnel record survey,

(6) personnel check-in/check-out

(7) optical character reader (OCR) document preparation,

(8) projected personnel gain/loss reporting.

The personnel record creation program should allow the user to add personnel records to the personnel record file (PRF). The program should ask the user for the social security number (SSN) of the crewmember whose personnel record is to be entered. If that SSN is not already on file, a record is created and the user is asked to enter the appropriate personnel record information. This information includes such items as name, rate, birth date, division, duty section, and security clearance. If the SSN initially entered is already on file, the program should inform the user to use the update program. If this happens the user can press the ESCAPE key (ESC) to return to the menu to

select the update program. When the user has finished entering the data for a new personnel record he can press the ESCAPE key whereupon he will be asked if he wishes to create another personnel record. A default answer of "Y" (for yes) will appear on the terminal and if the user presses the RETURN key he will be asked to enter the SSN of the next record. Typing an "N" (for no) will indicate to the program that the user is finished with the create program and the system will return to the program menu for selection of another program as desired. Access in and out of all the PTMS programs is handled in much the same way.

The personnel record update program should allow the user to accomplish simple or multiple updates of personnel records. There are four update options available:

(1) Single record, single item,

(2) Single record, multiple items,

(3) Multiple record, multiple items,

(4) Full activity, multiple items.

The user selects the option and enters the SSN of the crewmember to be updated (activity unit identification code in the case of option 4). He also enters the data item number(s) to be updated (e.g., (54) local street address) which are listed on the terminal for selection. The user can leave the particular data item unchanged or he can change or delete the items as required. When an update is

completed, the user has the option of updating another crewmamber's record, switching to another update option, or returning to the menu for another program.

The personnel record deletion program should permit users to delete personnel records from the personnel record file (PRF). Upon entry of the crewmember's SSN, the program will display the name of the person selected and will query the user whether he wants to delete the record. A default "Y" will appear whereupon the record can be deleted. Typing an "N" will abort deletion.

The personnel record review program should allow the user to review personnel records. The user can review an individual record, the records of a specific work center or NEC, or the whole unit's records. Within these categories the user can select specific data groups for review as follows:

(1) Entire record,

(2) General service data,

(3) Assignment data,

(4) Career/education/advancement data,

(5) Dependent/next-of-kin data,

(6) Leave administration data,

(7) Medical record data,

(8) Qualification data.

The personnel record survey program serves a review function similar to that of the personnel record review program with the exception that only terminal output is available and the data items available for display are tailored for specific users (e.g., career councelors, yeomen, corpsmen, etc.). Terminal screen formats are arranged to include only those data items needed by the specific user. Six formats are included in this program; (1) receipt and transfer, (2) career, (3) advancement, (4) evaluation, (5) religious and dependent, and (6) medical.

The personnel check-in/check-out program outputs a paper copy of a crewmember check-in or check-out sheet. The check-in sheet should include a personnel data verification section and a Privacy Act statement.

The optical character reader (OCR) document preparation program is intended to permit users to create, review, update, delete, and print OCR documents for submission to offship commands. Various pay and personnel reports are included in this category.

The projected personnel gain/loss reporting program can provide a terminal or hardcopy output of crewmembers who are expected to arrive to or depart from the ship within the next 90 days. Listings can be selected by rate or NEC. Information to be displayed includes crewmember's rate, division, reporting date (if a gain), loss date (if a loss), and PRD.

2. Personnel Assignment

The second group of programs in the Personnel Module pertain to personnel assignment; creating, updating, reviewing, and deleting personnel assignment data. This grouping of programs should help managers to properly assign personnel to work centers, locate personnel on and off the ship, and assist in watch bill preparation. There are eight programs grouped into the personnel assignment category;

(1) personnel assignment update,

(2) personnel assignment survey,

(3) personnel assignment roster,

(4) personnel recall,

(5) muster report,

(6) division officers' notebook,

(7) manpower availability status report,

(8) manpower availability forecast report.

A short description of the capabilities of each of these personnel assignment programs follows.

The personnel assignment update program should permit the user to review, update, and add personnel assignment data items of an individual. These items include billet sequence number, division, work center, duty section, watch qualifications, bunk number, local address, etc.

The personnel assignment survey program is similar to the personnel assignment update program with two exceptions. Information cannot be changed, only reviewed. Also the

information is grouped into four categories or screen formats that can be selected from the menu; (1) billet, (2)inport duty, (3) recall, and (4) locator. Records can be selected by SSN, NEC, duty section, or PRD.

The personnel assignment roster program can output a printed copy of personnel assignment data by division and work center.

The personnel recall program produces a hardcopy summary of personnel recall data, also by division and work center.

The muster report program is intended to produce paper copies of muster report worksheets for each division aboard ship.

The division officer notebook program produces a terminal or paper output of Division Officer Notebook data items for the entire ship or for selected divisions. Items include schools attended, past evaluations, time in rate, PRD, and a host of other information useful to the immediate supervisor.

The manpower availability status report program can prepare a hardcopy of terminal listing of personnel, by work center, who are available for tasking to jobs. Rate, duty section, qualifications, security clearance, and PRD are among the items included in this report.

The manpower availability forecast report program produces a terminal or paper listing of crewmember availability to perform a specific task broken down by qualifications and time period of the desired task. The user enters the required skill or task and the time period involved. The program outputs a list of personnel eligible and available for the task during the specified time period.

3. Personnel Qualification Administration

The third group of programs in the Personnel Module relate to personnel qualification. It is intended that this category will enable users to create, review, update, and delete information related to personnel training history, qualifications, and skills. There are three programs included in this category:

(1) personnel qualification update and review,

(2) personnel qualification summary,

(3) personnel qualification/requalification report.

The personnel qualification update/review program should allow users to add, update, and review a crewmember's qualifications and training history as well as monitor progress toward PQS qualification. Representative data items included in this program are qualification/ requalification due dates, planned and actual PQS start and completion dates, and PQS points earned.

The personnel qualification summary program is intended to provide a terminal or paper listing of individual

qualifications according to selected groups or categories (e.g., ship, department, division, work center, duty section, or individual). After the user selects the desired category, the program should output information concerning rate, division, work center, qualification type, title and date, and requalification date.

The personnel qualification/requalification report program produces a hardcopy or terminal report which lists personnel who require requalification in a particular skill during the next three months. It is intended to contain information such as name, rate, division, qualification, and requalification due date.

4. Personnel Leave Administration

The fourth and last grouping of programs in the Personnel Module concerns personnel leave administration. This function is designed to create, review, update, and delete personnel data related to leave. Three specific programs are grouped under this heading:

(1) personnel leave data maintenance and review,

(2) personnel leave status reporting,

(3) personnel leave paper preparation.

The personnel leave data maintenance and review program should help users to review, update, and add information related to an individual's current or future leave. Leave data manipulated by this program includes leave start/stop

dates, days requested, type leave granted (e.g., regular, emergency, etc.), and leave address.

The personnel leave status reporting program is intended to permit the user to obtain a hardcopy or terminal output of information related to personnel currently on leave or those projected to go on leave. The user will have the option of breaking down his request by various categories (e.g., ship, department, division, work center, or duty section).

The personnel leave paper preparation program should aid the user to prepare leave papers. This program should generate leave papers for individuals or selected groups of individuals who have been granted leave.

5. Billet and Skill Inventory Management

As previously discussed, the Training Management Module of PTMS contains three program groupings. The first category deals with billet and skill inventory management. It is hoped that this function will aid the user to create, review, update, and delete information related to billet requirements and assignment as well as billet skill proficiencies and shortfalls. The billet and skill inventory management function contains five programs:

(1) billet and skill inventory file maintenance,

(2) billet personnel assignment report,

(3) billet skill requirements and skill deficiency report,

(4) personnel onboard versus allowance report,

(5) Watch Quarter and Station Bill.

The billet skill inventory file maintenance program should assist users to create, review, update, and delete records contained in the billet/skill inventory file (BSF). Data items for review/updating are grouped into four categories;

(1) billet/watchstation requirements (e.g., billet sequency number, rate, NEC, watchstation, etc.)

(2) billet personnel assignment (e.g., SSN, rate, division, PRD, etc.)

(3) billet skills (e.g., billet skill identification code)

(4) requirements/proficiency (e.g., billet skill title, skill proficiency)

The billet personnel assignment report program can generate a hardcopy report listing billets required to be filled along with the names of those jobs already filled by ship's personnel. This report is organized by division and billet sequency number.

The billet skill requirements and skill deficiency report program lists the skills required by the person holding a particular billet aboard ship. It should also list the skills which are or are not held by the person occupying that job. The user will be able to choose billets by ship, department, division, work center, NEC, or PRD.

The personnel onboard versus allowance report program should help the user compare a list of personnel currently

assigned with a list of billets authorized for the ship. This program should generate a hardcopy or terminal output to help identify manning and skill area shortfalls/overages.

The Watch Quarter and Station Bill program is intended to prepare a hardcopy listing of Watch Quarter and Station Bill assignments by division. This paper output should be convenient for posting in appropriate work spaces and living quarters.

6. Training Requirements Management

The second program grouping in the Training Management Module concerns training requirements management. It is hoped that this function will allow users to create, review, update, and delete date related to training requirements. Outputs from this program grouping include training event description, scheduling, progress tracking, history, and deficiency reporting. Training requirements reporting is also included under this heading. Three specific programs are included in the training requirements management package:

(1) training requirements file maintenance,

(2) training requirements summary,

(3) training event history and deficiency reporting.

The training requirements file maintenance program should allow the user to review, update, create, and delete records in the Training Requirements File (TRF). The user will be able to select one or both of the following data groups for

data manipulation; event identification and description and/or event scheduling and progress. Representative data items included in the event identification and description category are event long and short title, periodicity, priority, mission area, action officer, evaluation method, outside services required, and event description. The event scheduling and progress category includes such items as event status (e.g., accomplished, ongoing, or planned), start/stop dates, and evaluation score.

The training requirements summary should generate a terminal or hardcopy summary of all ship's required training events by various categories. These categories include ship, department, division, work center, duty section, or action officer responsible for the event.

The training event history and deficiency reporting program is intended to produce a terminal or paper listing of past and future training events. It will also note overdue events along with the number of days that they are delinquent. Training events can be selected by ship, department, division, work center, duty section, and individual.

7. Required School Management

The last group of programs in the Training Management Module pertain to required school management. It is hoped that this function will assist the manager to create,

review, update, and delete information related to ship's required schools. Reports related to training course description and quota control, student scheduling and orders preparation, and graduate status and shortfalls are included in this package. There are six programs contained in this grouping:

(1) school requirements file maintenance,

(2) school catalog summary,

(3) required school graduate status reporting,

(4) school quota control,

(5) student assignment and scheduling,

(6) school orders preparation.

The school requirements file maintenance program should permit the user to review, update, create, and delete records in the School Requirements File (SRF). The user can select one or more of the following data categories for file manipulation; course identification, graduate status, quota control and/or student/graduate schedule/inventory. Representative information contained under the course identification include course title and identification number, course description, location, length (weeks), prerequisites, and the quota control command. The graduate status category will include data such as number of required graduates and number of onboard graduates. The quota control category should report number of quotas available and the class

convening date (CLCVN). The final category, student/ graduate schedule/inventory, will include information concerning name, rate, division, course start/stop dates, and status (student or graduate).

The school catalog summary program should provide the user with a display or printout of portions of the SRF grouped by either course identification number or course short title. The user will have the option of selecting various output categories according to school, location, NEC supported, or range of class convening dates. Information provided by this program includes course identification number, title, location, length, and CLCVN.

The required school graduate status reporting program can aid the user with a terminal or hardcopy list of required schools and the status of the graduates of those schools. Data provided in this report includes course title, required and onboard graduate count, and the names, divisions, and PRD'S of the graduates. Any future date can be selected to provide information on required school graduate status.

The school quota control program should produce a listing of quotas, available and filled, for the next 90 days. Data provided in this summary includes course identificaiton number, course title, required graduate deficiency count, quotas available, and CLCVN.

The student assignment and scheduling program should provide a listing appointed candidates and school assignment

information concerning in-progress and future schools. Name, division, status (candidate, student, graduate), course title, location, and CLCVN are representative data items included in this report.

Finally, the school orders preparation program should produce the required temporary additional duty (TAD) orders for school candidates as selected by the user.

IV. CRITICAL ANALYSIS

The previous two chapters provided a description of the functional requirements of SNAP and PTMS. SNAP is intended to automate a broad range of shipboard applications while PTMS is aimed at a specific segment of functional areas; personnel and training management.

The analysis of any problem can be stated in three basic types of questions:

(1) What is the problem?

(2) What are the alternative solutions?

(3) What is the best solution?

More specifically, the following questions will be addressed:

(1) What is the problem that SNAP/PTMS are designed to address?

(2) What are the constraints and limitations associated with the problem?

(3) What are the assumptions associated with the problem?

(4) What is the environment; opportunities, threats?

(5) What are the objectives of SNAP/PTMS?

(6) What are the alternatives?

(7) What are the measures of effectiveness (MOE) and criteria for success?

(8) Which is the best alternative solution to the problem?

The above sequence of questions make up what is known as the "top down" approach to analysis. The problem is viewed from the perspective of the whole organization and the emphasis is on ensuring that solutions satisfy the goal of the organization as an integrated and coordinated unit.

A. PROBLEM IDENTIFICATION

The problem, as stated by the Navy, is that there is an excessive administrative burden on the fleets. The questions might be asked; Is this a valid problem? Is it worth addressing?

The problem of excess administrative burden on the fleets is well known but not well documented. As stated in the introduction to this thesis, "crisis management" is the third ranked reason why mid-grade officers are leaving the service. Excessive, unnecessary paperwork and inspections were cited by respondents as the main components of crisis management. This is qualitative evidence at best.

It appears that, from a qualitative perspective, an administrative burden does exist at the fleet level. But is this problem worth addressing? From a purely conceptual, strategic viewpoint the mission of the Navy can be segmented into two general functions; operational and support. The Navy's overall operational mission is to provide national defense, protect the sea lanes of communication, and project

a mobile force to selected areas of the world. The support forces exist to aid the operational forces to perform their mission. Obviously, at the organizational level, the more resources that can be directed to the operational forces, the more effective the national defense will be.

This is the old "tooth and tail" delemma. The real bite of national defense is contained in the operational forces. However the support forces serve a vital role as the "tail" of the organization. They provide many logistical services that enable the fleet to perform its job. The problem in an environment of scarce fiscal and manpower resources is to allocate those resources in an efficient and effective manner. The objective is to provide as much men and money to the operational forces while providing a lean but effective support force.

The same goal applies at the microscopic level of the operational unit. The ship's limited availability of money, manpower, and time must be divided between operational and support functions. The more of these scarce resources that can be devoted to "fighting" functions, the higher the combat readiness of the unit will be. Therefore the operational functions of personnel training and equipment maintenance should take priority over the support functions of inspections, reporting, and administrative paperwork.

SNAP and PTMS can reduce the cost of performing administrative and support functions, in terms of manhours consumed.

This researcher is not advocating a dissolution of the support function but merely a shift on the operational-support spectrum away from support and toward operational functions. Strategies and programs should be investigated, developed evaluated, and implemented to mitigate the cost of resources consumed by support functions so that resources can be shifted to the operational functions. SNAP and PTMS are programs that serve this end.

B. CONSTRAINTS AND LIMITATIONS

One of the main constraints associated with the problem identification is that, although the existence of the administrative burden is known, the elements of the burden are not understood. Without a clear, quantitative understanding of the elements of the administrative problem, a scientific solution cannot be applied. A vague understanding of the problem limits the solution alternatives to imprecise and possibly inappropriate possibilities. Poor alternatives neccessarily produce less than optimal solutions.

To this researcher's knowledge, a detailed analysis of the functions of shipboard managers has not been undertaken. The Navy has no quantitative evidence on what

specific tasks a manager performs aboard ship, how long each task takes, or what percentage of the working day a shipboard manager spends on various types of administrative tasks.

A front-end solution to this problem can be attained through the use of services provided by the Navy Manpower and Material Analysis Centers, Atlantic and Pacific. These centers maintain teams of experts who visit ships, at the ship's request, to conduct work studies. Work studies involve developing improved work methods and measuring the time taken to accomplish various shipboard tasks. The team observes personnel at work, collects data on what activities are performed, and how long a particular task takes. As unbiased observers, they can make recommendations concerning improved work methods.

It is the recommendation of this researcher that the Navy solicit ships to voluntarily participate in a work study program for shipboard managers. The sampling should include all officers plus selected enlisted personnel who perform personnel management functions (e.g., chief petty officers, leading petty officers, career counselors, and training petty officers). Data should be collected concerning what administrative functions they perform, how long it takes to perform each type of task, and what percentage of the workday they spend performing administrative and supervisory tasks.

Armed with quantitative data, work study analysts can begin to make recommendations of methods to improve the efficiency and effectiveness of shipboard managers. Certainly many tasks are candidates for consolidation, reassignment, automation, or elimination. By studying the administrative functions of managers, the Navy can begin to understand the aspects that contribute to crisis management and the administrative burden on the fleets. Perhaps if a work study analysis had been conducted prior to the development of SNAP, the resulting functional description might have looked quite different. It would also have given the fleet managers a say in what SNAP should look like from their perspective.

Another limitation in the evaluation of SNAP/PTMS is that neither system is available to evaluate. All that is available at this point is the functional description of what the systems are designed to do. Without the hardware and software to analyze, researchers are limited to a rather cursory, qualitative, and theoretical look at the systems.

Scarce resources, while not unique to this problem, comprise another constraint to its solution. With few exceptions, notably during wars, the Armed Services have operated under fiscal constraints. The services have spent their scarce dollars on new weapons systems rather

than people and spare parts. This can be traced to the priorities of both Congress and the services.

Increasingly complex weapons systems have created a demand for skilled technicians to operate and maintain them. Because of pay differentials that exist between the military and civilian sectors, the services have had a difficult time recruiting and retaining technicians. Meanwhile, as the post-World War II baby boom winds down, the supply of 18-21 year old potential recruits is dwindling. In 1978, the height of the supply of "baby-boomers", the services had to recruit one out of every six eligible males to maintain force strengths. By 1992, the supply of recruits is predicted to decline by 25% and one out of four eligable males will have to be attracted to meet projected needs. [Ref.7: p.51] The anticipated shortages of skilled personnel along with the historical budgetary pinch compel the Navy to seek means to make its personnel more efficient and effective. The Navy will have to do more with less and these constraints limit the available choices. Functions that are inordinate resource consumers will have to be analyzed to determine if their contributions to the missions of the Navy are worth the costs in terms of money and manhours. Functions that are not cost-effective will have to be made more efficient or eliminated.

C. ASSUMPTIONS

With SNAP and PTMS in the development stages, the observer cannot examine the systems "in the flesh" to see how or if they work as advertised. At this point observers can only give the designers the benefit of a doubt and assume that SNAP and PTMS will perform most of the designated functions as depicted in the integrated functional descriptions.

D. ENVIRONMENT

The external environment consists of the technology available and the political forces acting on the Navy. The technology available is increasing at a geometric rate. The capacity of computers has roughly doubled every three years while the cost per bit of information is steadily declining. Today's computers are faster, smaller, more flexible, more reliable, and "friendlier" to users than yesterday's computers. While the rate of progress of computer technology has not kept pace with the predictions of ten or fifteen years ago, the progress has been steady. The continued advances in computer technology is one part of the environment that users can rely on.

Steady technological progress can be contrasted with the flux found in the political environment. Politicians in the Executive and Legislative branches of the federal government come and go with regularity. They bring different policies, perspectives, and priorities which, hopefully, reflect the changing moods of the citizens. Military leaders have tried to shift with the changing tides with varying degrees of success. The services engage in constant, often bitter, competition for a larger piece of the defense budget pie. Government agencies are required to justify expenditures in cost-effectiveness terms to ensure that the American people are getting their bang out of the defense buck. The political environment has a definite effect on the alternatives available to defense planners. As a result, most defense projects operate on a fixed-effectiveness, minimum cost basis. Those projects that do not impact directly on the combat readiness of the forces or are perceived by legislators as too costly have a difficult time surviving the funding process. This is perhaps one reason why the emphasis of SNAP is so heavily on the maintenance and supply areas.

There are problems associated with the internal environment as well. The organizational structure of the Navy can be described as hierarchical and institutionalized.

Tradition tends to promote the status quo and dramatic changes are often difficult to carry out due to institutional inertia. Compromise, satisfice, and marginal change are the watchwords for those who want to survive in the system and thereby gain the seniority/rank required to make changes. The Navy way, standard operating procedures and doctrines may provide a more cohesive fighting force but the side effects tend to include inflexibility and resistence to change. The administrative burden on the fleets is a longstanding problem that requires new alternatives to the "paperwork drill". Convincing the bureaucracy that the effort is worth the benefits may not be easy.

E. OBJECTIVES

The objective of SNAP and PTMS is to reduce the administrative burden on the fleets through the introduction of computers to automate formerly manual administrative functions. It is anticipated that automation will produce more accurate and timely preparation of required reports. It is also hoped that automation will result in time savings and thus more efficient utilization of scarce manpower resources.

Specifically, both SNAP and PTMS are designed to automate current manual procedures. Little attempt has

been made to design new administrative procedures. The sheer volume of current manual functions cited in the last two chapters provide plenty of grist for the computer's mill.

Another objective of SNAP and PTMS is to provide a user friendly system that requires minimal training for maintenance men and operators. It is hoped that this goal will minimize the cost of implementation and promote the acceptance of the system in the fleet.

The most important aspect of the goals of SNAP and PTMS is that both systems claim to be oriented toward the operational fleet user. The purpose of SNAP/PTMS is to reduce the administrative burden on the fleet, not the shore establishment. This objective statement reflects an understanding that the function of the fleet is primarily operational and that reducing administrative requirements at the fleet level will ultimately free resources for commitment to operational objectives. This shift in resourse delegation should have a direct positive impact on fleet readiness.

However, the history of SNAP described earlier shows that from the beginning stages of development, SNAP concentrated on the supply and maintenance applications almost exclusively. Out of approximately 200 functions described in SNAP, about 175 are associated with supply and

maintenance. The shore establishment has a vested interest in these functions as they comprise the raison d'etre of many of the supporting shore commands. The vast majority of reports associated with supply and maintenance are generated by the fleet for the consumption of shore commands. The fleet user perceives these "outside" reporting requirements as just more paperwork which sits on someone's desk ashore. From an overall organizational perspective, these reports benefit the fleet through better supply and maintenance support. But these benefits are seen at the fleet level as indirect and long term. This emphasis on equipment tends to lose sight of the Navy's most valuable resource, people. Roughly 65% of the defense budget goes to people programs and this would appear to be where the Navy should focus its efforts to improve administrative procedures.

While SNAP focuses on equipment, PTMS is concerned with people. PTMS was developed at the shipboard level by functional users. The result was a software package that satisfied the needs of personnel in the fleet.

In 1980, Commander Naval Surface Forces, U. S. Atlantic Fleet (COMNAVSURFLANT) authorized U.S.S. COONTZ (DDG-40) to lease a mini-computer system with data management and word processing capability. The objective was to develop

and recommend ship-initiated computer applications for inclusion in the SNAP program [Ref.8]. It is important to emphasize that the project was initiated by an operational fleet commander and the resultant software package was developed at the shipboard level by and for users. The structure of the Coontz Data Management System (CDMS) is shown in Figure 3. Perusal of Figure 3 shows that the vast majority of the applications generated at the fleet level were in the area of administration and training. This reflects where the needs emphasis exists at the user level.

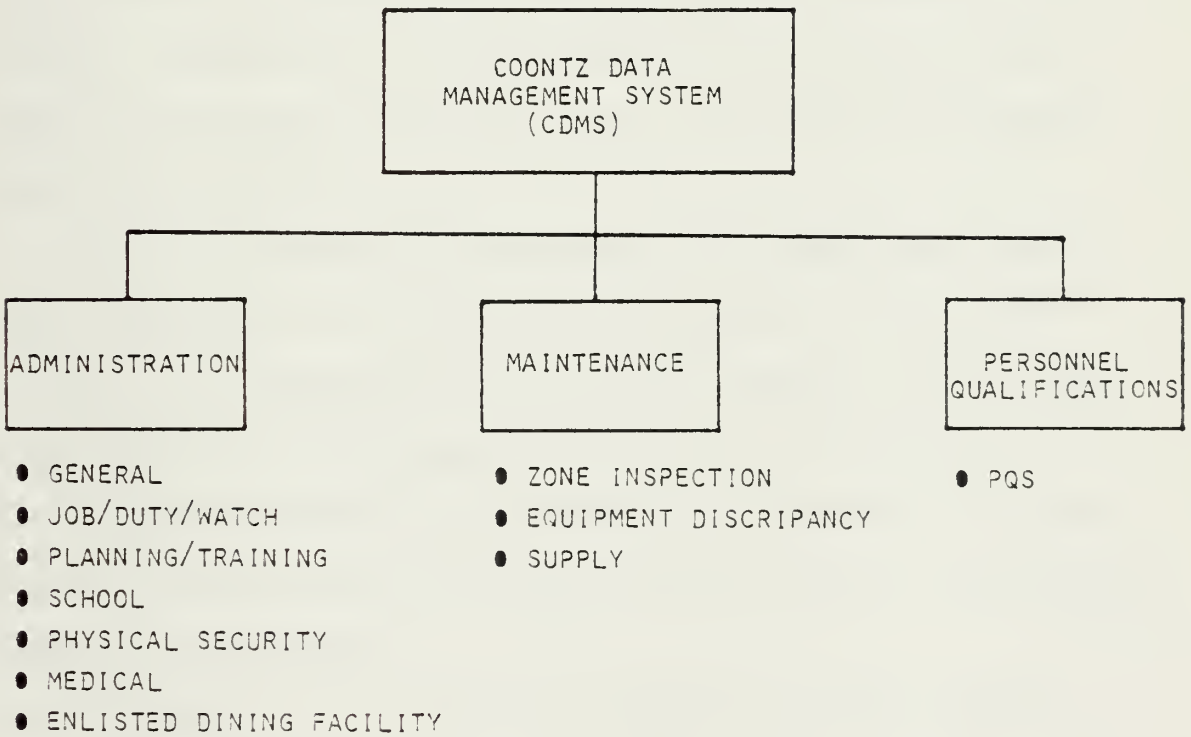


FIGURE 3. COONTZ Data Management System Subsystem Structure

It is perhaps unfair to criticize SNAP for its emphasis on supply and maintenance. Applications in these areas might be very difficult to develop at the fleet level. Since PTMS deals exclusively with personnel applications it is more thorough than SNAP in this area. However it is the opinion of this observer that the needs of the shipboard user reflect a need for greater emphasis in the area of personnel/training/administration than SNAP provides.

F. ALTERNATIVES

The decision to automate shipboard administrative functions has already been made. Shipboard testing cited earlier revealed that installation of off-the-shelf computer hardware was feasible from a reliability and maintenance perspective.

While the software requirements for SNAP have already been designed, one of the main advantages of the system is that it is designed to be flexible enough to allow incorporation of future applications. So the question of what functions should be included in the system will continue to be of concern as SNAP evolves over its anticipated twenty year lifetime.

A framework for analysis is helpful at this point. The real purpose of a computer is to provide information to support the decision-making process of managers. A

look at the types of decisions, the types of management activity, and the characteristics of information required to make decisions is useful in deciding which type of computer software to install.

Anthony has provided a scheme for classifying decision-making in relation to potential types of computer support. [Ref.9: pp.81-3] The first level of decision-making is called strategic planning. This is the process of deciding on objectives and the resources to accomplish the goals. Strategic planning normally involves top echelons of management and generally requires innovation, creativity, and an understanding of the organizational environment.

The second category is management control; managers procure and assign resources to assure the efficient and effective accomplishment of organizational objectives. This process involves interpersonal coordination in the performance of tasks.

The last category of decision-making is called operational control; the process of assuring that tasks are accomplished in an efficient and effective manner. Predefined, structured tasks are the objective of operational control.

Obviously one cannot pigeonhole every decision into a discrete category; this scheme represents a continuous

spectrum where decision types overlap each other. The information needs for each type of decision are very different. Figure 4 shows the various characteristics of information in relation to the three types of decisions.

TASK VARIABLES	STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
Accuracy	Low	⟷	High
Level of Detail	Aggregate	⟷	Detailed
Time Horizon	Future	⟷	Present
Frequency of Use	Infrequent	⟷	Frequent
Source	External	⟷	Internal
Scope of Information	Wide	⟷	Narrow
Type of Information	Qualitative	⟷	Quantitative
Age of Information	Older	⟷	Current

FIGURE 4. Information Characteristics By Area of Decision

The orientation of SNAP and PTMS is toward the operational control end of the decision spectrum. SNAP and PTMS are designed to automate structured tasks where standard operating procedures are well defined and efficiency of operation is a main concern. At the operational level, managers need accurate, detailed information for short term application to current problems.

The fact that SNAP is starting at the lower end of the decision spectrum has great implications for the potential growth of the system. SNAP has a great deal of room to evolve as experience leads the way to applications at the managerial and strategic levels. While these types of support should be in the back of the designer's mind, concentration should be focused on structured tasks in the early stages of SNAP development. This is the best way to ensure a solid base from which to evolve better applications.

G. MEASURES OF EFFECTIVENESS

In order to evaluate SNAP and PTMS, measures of effectiveness (MOE) are needed. Criteria must be established to evaluate each application in terms of the overall objective of reducing administrative burden.

SNAP prototypes have already passed operational tests for reliability, maintainability, logistics support, com-

patibility, interoperability, and training requirements. These criteria, however, are mostly a function of the hardware. Off-the-shelf computers have proved their ability to operate effectively in the shipboard environment.

Users tend to be more interested on soft criteria such as flexibility, expandibility, efficiency, and friendliness. Users want a system that meets their daily administrative needs and frees them to perform operational tasks. Managers need a system that can evolve to suit changing needs and is easy to operate. If users perceive that SNAP is not meeting their needs or that it is too difficult to operate, they won't use it and SNAP will be a failure.

H. CONCLUSIONS

Both SNAP and PTMS are aimed at solving the administrative burden at the fleet level. There are some problems associated with the approach that the development of SNAP has taken. Firstly, little quantitative evidence exists concerning exactly what elements make up the administrative burden at the fleet level. Also the development of SNAP has taken the "top down" approach. SNAP appears to satisfy the data requirements of the shore establishments; data which is supplied by the fleet. Hence there is a great emphasis on supply and maintenance information

applications in SNAP. This gives SNAP the appearance of existing by and for the shore establishment as seen by the fleet user.

The development of PTMS, however, has taken a "bottom up" approach. It was developed by and for fleet users and more clearly reflects their needs.

As recommended earlier, the Navy should undertake a work study analysis at the shipboard level to determine what functions are performed by managers. This "bottom up" approach would help define where the administrative burden exists. Armed with quantitative evidence concerning managerial tasks, their periodicity and composition, analysts can assign functional priorities for inclusions in SNAP. This approach would ensure that the functions included in SNAP were useful to the shipboard manager and would thus ease acceptance to the system.

It is also recommended that a personnel and training module similar to PTMS be incorporated into the nucleus SNAP software package. PTMS reflects user's needs and without the support of personnel at the fleet level the whole SNAP program may be in jeopardy.

V. RECOMMENDATIONS FOR INSTALLATION AND FUTURE APPLICATIONS

A. INSTALLATION

1. Approach

An intelligent approach to implementation is vital to the potential success of any computer system. Computer specialists can design the best system extant but if the hearts and minds of users are not won over during the implementation phase, the system will probably fail.

Computer analysts have used the "factor" approach to study why various computer implementation efforts have succeeded and others have failed. The factor approach involves making case studies of organizations to determine what circumstances contribute to their success. Studies thus far have revealed very few absolutes for success, however. Much depends on the type and size of the organization, the information requirements, decision types, management philosophy, etc. However a few general conclusions can be made. [Ref.9: pp.195-199]

Probably the most important factor affecting the successful implementation is the support of top management. Top managers set the tone for the whole organization and their belief in the computer system will help

build confidence all along the chain of command. Lower level managers are more likely to use the system if they are encouraged by a top management that actively supports and uses the system.

A clear "felt need" is also required by users. This means that the computer system must address problems which are visible and relevent from the user's perspective and are viable problems. Problem recognition helps ensure that the manager is motivated to make a commitment to the use of the computer system.

Implementors have suggested that a lack of education is a weak link in the early stages of computer system installation. Users at all levels of the organization must be educated in the general philosophy behind the system as well as the mechanics of system operation. Managers who are not aware of the problem addressed by the system or who do not possess a "felt need" must be educated in these areas. Hopefully this will help foster the motivation and commitment required for system success.

Part of this education involves the management of change. Rigidity and conformity are common in large, bureaucratic organizations. New technology can upset the existing patterns of authority and status. Installation specialists tend to ignore these human factors and concentrate only on the technical aspects. Consultation of

users is very important to the management of change. There will be a certain amount of resistance to the introduction of SNAP and the early goals of implementation should include steps to mitigate this obstacle to success. Managing change can be viewed as a three step process; (1) unfreezing, (2) moving, and (3) refreezing.

Unfreezing refers to altering an individual's equilibrium sufficiently to motivate him to accept change. This can be accomplished by active pressure to change or by self-motivation through reducing threats and resistance to change.

Moving involves the actual changing of attitudes toward the computer system. Education must win over the hearts and minds of users to instill a belief that the system will help solve the problems of the organization.

Refreezing addresses the permanent acceptance of the system by users. The system must address the needs of the users if it is to be accepted in place of the previous mode of operation.

Design and education are the keys to ensure that "factors" associated with successful implementation are addressed. If the computer system is designed with the user in mind and it addresses his needs, then much of the battle is won. If users perceive SNAP as "their" system

then much of the resistance to change will disappear because motivation will provide the impetus ufor acceptance.

A certain amount of education will be required to make users aware of the advantages of automation. This education should start at the ship's commanding officer/executive officer level to ensure top management support. Department heads and division officers should be given the next priority. Prospective commanding officer/prospective executive officer schools, Department Head School, and Surface Warfare Officer's School are the best sites to educate managers. SNAP systems should be provided to these schools to aid in the education of top management. Aboard ships, education should start well before installation teams arrive. Six months prior to installation the ship should receive a package of plan-of-the-day (POD) notes that describe the functional capabilities of SNAP in easy to understand language. Continuous, long term exposure to the system should help "unfreeze" potential users and establish self-motivation for the acceptance of SNAP. A few posters with pictures of the SNAP system and a brief description of its advantages should also be provided for posting around the ship.

2. Installation Teams

Installation is intended for about 450 ships and submarines over a five to six year period starting in mid-1982. This researcher proposes that the Navy utilize

installation vans similar to the Mobile Versatile Training System (MVTS) located at the Navy Personnel Research and Development Center, San Diego. This motorized van has the capability to carry the SNAP central processing unit (CPU), a training data base, high speed printer, and six terminals. This configuration would provide a mobile, self-contained mini-SNAP system convenient for ship-side training.

An eight man installation/training team is also recommended. This team would include two contractor representatives with technical skills (for installation) and training skills. Six Navy representatives should also be included in the team. A LT/LCDR should head the team with two technical/training enlisted members (ET, IC, EM, DS, FT, or ST) and three training only members (YN, SK, or other general rating).

A one week (five working day) installation/training schedule is recommended per ship. This would permit two vans (one per coast) to install SNAP on 450 ships in just over five years. This schedule is based on an eleven month van availability to permit time for van maintenance, travel, and team leave periods. Provisions of more than two vans could obviously speed up the delivery scheduled considerably. Days 1-3 should be used to install SNAP aboard the ship and

condict user training in the MVTS. Days 4-5 should be used for onboard data base implementation assistance. This schedule is considered feasible since pre-SNAP systems have been installed in about two and a half days.

B. FUTURE APPLICATIONS

For reasons stated above, future SNAP programs should take into consideration the stated needs of fleet users. Periodic consultation between SNAP designers and users could be accomplished via SNAP conferences held at major fleet ports. Some future applications are recommended below.

1. Routing Tickler

One way to cut down on the volume of paper that flows within the ship's chain of command is to put it in a computer. Memorandums and message traffic are two candidates for inclusion in a SNAP routing tickler.

Many times during the working day a manager needs to contact a person on the ship but is unable to locate the crewmember. Ship's service telephones have helped in this regard but legwork is all too prevalent. Memos are often written but must be delivered and tend to get lost along the way.

SNAP should include the capability to generate memos to any person assigned a user identification number.

A memo function could be made available on the SNAP menu for ease of selection. After selection of the memo function, the terminal should display the billet names of all users as well as convenient groupings of users (e.g., all officers, all chiefs, department heads, division officers, etc.). After selecting the routing list, the user could enter his memo. The memo should include automatic input of user's billet name, date, and time of message generation. The next time each addressee logs onto the system, the pending memos should automatically appear on the terminal.

2. Message Routing/Filing

Every ship receives volumes of message traffic each day, especially during deployments. SNAP should have the capability to route message traffic via terminals to cut down on the volume of paper message traffic.

The message routing function should have the capability of permit memos to be written on each message to facilitate notification of action officers by senior managers. Personnel receiving message traffic should have the ability to erase, save for future reference, or file each message. The filing capability should have at least two levels. For instance, a message might pertain to communications in a future training exercise. The user should be able to file the message under the exercise

name, and within that exercise file, under a communications file. Users would be able to set up files to suit their needs with a file menu to aid in retrieval of messages.

3. Publications

Throughout the course of a year each ship receives various administrative, operational, and technical publications. Action officers rarely have time to scan, much less read, many of these publications.

All publications, manuals, and operation orders should be received on the ship in diskette form for entry into SNAP memory. Each publication should contain an executive summary and a functional user summary. The executive summary should be brief and broad in scope for quick perusal by the commanding officer and personnel who do not require a detailed knowledge of the contents. The functional user summary should be more detailed for use by action personnel. The executive summary should be provided to authorized users via the routing tickler with the option to call up the functional user summary or the document itself.

Publication changes should also be received in diskette form (when the ship in inport) to facilitate easy entry into the original publication. It is not unusual to receive 50 separate changes to an operation order and pen and ink insertion is a very time consuming process if ten

or more copies require updating. These changes should also be included in the daily tickler so that action officers are made aware of them as soon as possible.

4. Computer Assisted Instruction (CAI)

Computer assisted instruction is another area of potential use for SNAP. Personal Qualification Standards (PQS) manuals and check-off books should be inserted in SNAP to assist crewmembers attain training qualifications. SNAP would be particularly beneficial in qualification testing. A master list of questions from each module could provide a random sample of test questions for the student. Upon receiving a predetermined minimum score, a record would be made notifying the training petty officer that the student had qualified in that PQS item. Questions from the Damage Control PQS test could be used for ship-wide training via insertion in the plan-of-the-day.

5. Weekly Planner

Managers sometimes have difficulty getting organized for the weeks activities due to the many types of events in progress. A weekly planner tailored to the individual's schedule would help the manager keep track of his responsibilities. This planner would provide automatic input of scheduling information from the plan-of-the-day, planning board for training, operation orders, memos, etc.

VI. SUMMARY AND CONCLUSIONS

This thesis has provided a description of the functional requirements of the Shipboard Non-Tactical Automated Data Processing Program (SNAP) and the Personnel Readiness and Training Management Subsystem (PTMS). SNAP is a mini-computer system proposed for installation in ships and submarines starting in mid-1982. Applications addressed by SNAP include maintenance, supply, and personnel/administration. PTMS is a subsystem that has been proposed for inclusion in the SNAP software. PTMS addresses the areas of personnel, administration, and training.

Both programs are being developed to address the problem of administrative burden at the fleet level. Analysis of SNAP from a user's perspective reveals that it is heavily weighted toward the information requirements of the shore establishment; namely the supply and maintenance functional areas. This emphasis may be perceived by users in the fleet as not addressing their information needs. PTMS, on the other hand, was developed at the fleet level and more clearly addresses the administrative burden that exists there.

It is the opinion of this author that not enough quantitative research has been accomplished on the nature of

the administrative burden at the fleet level. Work studies are recommended to provide data on what managers do aboard ships. This "on-site" evaluation is necessary to the development of a computer system that will meet the needs of users in the fleet.

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